

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed
☐	☒ The exact sample size (<i>n</i>) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒ A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒ The statistical test(s) used AND whether they are one- or two-sided <i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i>
☒	☐ A description of all covariates tested
☐	☒ A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒ A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☒ For null hypothesis testing, the test statistic (e.g. <i>F</i> , <i>t</i> , <i>r</i>) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> value noted <i>Give P values as exact values whenever suitable.</i>
☒	☐ For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐ For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐ Estimates of effect sizes (e.g. Cohen's <i>d</i> , Pearson's <i>r</i>), indicating how they were calculated

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection	For data collection, the main software used are ImageJ software with the NeuronJ and Sholl plugins, digital slice scanner (3DHISTECH, Hungary), SMART3.0 behavioral video tracking system (Panlab, Spain) and Multi Conditioning System 2.0 (TSE Systems, Germany)
Data analysis	For data analysis, the main software used are Cell Ranger (version 6.0), R package Seurat (V4.1.1), SMART3.0 behavioral video tracking system (Panlab, Spain), Multi Conditioning System 2.0 (TSE Systems, Germany), GraphPad Prism 8 and IBM SPSS version 22.0.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

Single-cell RNA-sequence raw data are available in the Sequence Read Archive (SRA) under the accession number PRJNA1131648. The source data behind the graphs in the paper can be found in Supplementary Data 1.

Human research participants

Policy information about [studies involving human research participants and Sex and Gender in Research](#).

Reporting on sex and gender	Not applicable.
Population characteristics	Not applicable.
Recruitment	Not applicable.
Ethics oversight	Not applicable.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	The number of mice in the experiment was determined based on general principles of animal research and previous literature reports.
Data exclusions	The animals were excluded if they suffered accidental death or injured due to fighting.
Replication	To validate the reproducibility of the results, we conducted repeated experiments in at least three batches of animals. All experiments yielded consistent results, indicating that our findings are highly reproducible.
Randomization	In this study, animals are randomly assigned to the control and Cd-exposed group using a computer-generated random number table to ensure group balance and reduce selection bias.
Blinding	A double-blind method is used in behavioral experiments, but not in other experiments.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems		Methods	
n/a	Involved in the study	n/a	Involved in the study
☐	☒ Antibodies	☒	☐ ChIP-seq
☒	☐ Eukaryotic cell lines	☒	☐ Flow cytometry
☒	☐ Palaeontology and archaeology	☒	☐ MRI-based neuroimaging
☐	☒ Animals and other organisms		
☒	☐ Clinical data		
☒	☐ Dual use research of concern		

Antibodies

Antibodies used	KI67 antibody, ab15580, rabbit, 1:100, Abcam, UK; SOX2 antibody, AB5603, rabbit, 1:200, Millipore, USA.
Validation	KI67 antibody: https://www.abcam.cn/products/primary-antibodies/ki67-antibody-ab15580.html ; SOX2 antibody: https://www.merckmillipore.com/CN/zh/product/Anti-Sox2-Antibody,MM_NF-AB5603 .

Animals and other research organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research, and [Sex and Gender in Research](#)

Laboratory animals	Both female and male eight-week-old wild-type C57BL/6J mice, and the offspring from the treated pregnant mice at indicated age.
Wild animals	The study did not involved wild animals.
Reporting on sex	Both male and female fetus or offspring were used in the experiments.
Field-collected samples	Not applicable.
Ethics oversight	All animal experimental protocols were approved by the Animal Care and Use Committee of Army Military Medical University (ethical approval number: AMUWEC20218102).

Note that full information on the approval of the study protocol must also be provided in the manuscript.